

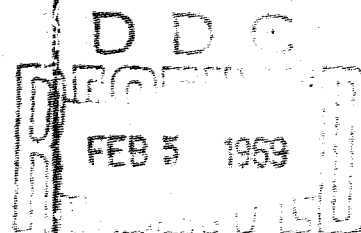
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TECHNICAL REPORT  
69-52-050

**U.S. ARMY NATICK LABORATORIES EQUIPMENT  
UTILIZATION STUDY AND  
MANAGEMENT CONCEPTS AND OPERATING  
PROCEDURES**

by  
J. Fred Oesterling



December 1968

UNITED STATES ARMY  
NATICK LABORATORIES  
Natick, Massachusetts 01760



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## FOREWORD

In consonance with a commitment made to the Honorable Henry S. Reuss, Chairman, Subcommittee on Research and Technical Programs, House of Representatives, by the Scientific Director of the U.S. Army Natick Laboratories a study on equipment management and utilization, with emphasis on the use of elapsed-time meters, was conducted during the period September 1967 - October 1968.

The study was carried out under the aegis of an Advisory Committee on Equipment Utilization appointed from within Natick Laboratories and was composed of representatives of management, supervisory personnel, laboratory bench workers and the Equipment Manager.

This report presents the findings and recommendations of the Advisory Committee on Equipment Utilization and NLABS Equipment Management Concept and Operating Procedures.

# ABSTRACT

The results of a study on equipment utilization and a review of management concepts and operating procedures at U.S. Army Natick Laboratories are reported.

U.S. ARMY NATICK LABORATORIES EQUIPMENT UTILIZATION STUDY  
and  
MANAGEMENT CONCEPTS AND OPERATING PROCEDURES

SUMMARY

Equipment management embodies (1) acquisition control, (2) optimum utilization, (3) turn-in of unused, excess or obsolete equipment, (4) equipment pool, (5) maintenance, repair and calibration of laboratory equipment, and (6) annual inventories. Effective implementation of items (1), (3), (4), (5), and (6) will assure optimum utilization of equipment assets.

During the past year a study was conducted on equipment management and utilization, with special emphasis on the use of elapsed-time meters. A summary of results and operational procedures follows:

a. Acquisition of New or Surplus Equipment requires internal review by at least three qualified persons within the laboratory, approval by the Laboratory Director, concurrence of the Equipment Manager and final approval by the Scientific Director. This program has been operative for almost three years and has been effective in eliminating unnecessary duplication or the purchase of unneeded equipment. This program will be continued.

b. Utilization (Elapsed-time Meters). Elapsed-time meters in themselves are not adequate as a sole or primary means of determining satisfactory equipment utilization. Elapsed-time meters will be used primarily for calibration scheduling purposes, with the information obtained therefrom also serving as an indicator of items which may be pooled.

c. Turn-in of Unused, Excess and Obsolete Equipment will be accomplished by: (1) laboratory walk-throughs, (2) disposal of old equipment to make room for new, (3) command inspections, (4) annual inventories, (5) housekeeping inspections, and (6) the assignment of responsibility to the Laboratory Director for certifying annually that excess equipment has been identified and turned in. All phases except item (6), which will be implemented by 1 January 1969, are in effect and are being continued.

d. An Equipment Pool stocked with 370 items, valued (new) at \$85,000., is in operation. Eighty-eight pieces of equipment are currently on loan and a total of 154 have been on loan during the 1st and 2nd Qtrs, FY'69. An "inventory" equipment pool, which consists of a central listing and location of all equipment within the laboratory complex, has been in effect for almost three years. Three hundred and thirty-four items valued (new) at \$128,000 were transferred between laboratories during FY'68. The equipment pools are being continued.

e. Maintenance, Repair, and Calibration of appropriate equipment will be accomplished on a periodic recall basis. As each item is calibrated

it will be equipped with an elapsed-time meter to provide quantitative information on hours of on-line usage for future calibration and maintenance purposes. An estimated 2000 - 2500 pieces of equipment out of approximately 15,000 will lend themselves to installation of elapsed-time meters. Equipment on which elapsed-time meters show low meter readings will be checked for researcher retention needs.

f. Annual Inventories will be conducted in accordance with Department of the Army regulations.

THE PROGRAM AS SUMMARIZED ABOVE IS 90% OPERATIVE AND WILL BE 100% OPERATIVE BY 1 JANUARY 1969.

U.S. Army Natick Laboratories  
Equipment Management Concepts and Operating Procedures

The NLABS Equipment Management program is designed to assure optimum equipment utilization. It includes an Equipment Manager and covers: (1) acquisition; (2) utilization; (3) turn-in of unused, excess and obsolete equipment; (4) equipment pools (centralized and an inventory); (5) calibration through periodic recall; and (6) an annual inventory. Effective implementation of items (1), (3), (4), (5) and (6) will automatically result in optimum utilization. The program is currently 90% operational and will be 100% operational by 1 January 1969.

a. Acquisition of New or Surplus Equipment. Acquisition and the steps leading up to acquisition are most critical in the management and utilization of equipment. At this point a determination must be made as to the need, immediate intended use and potential longer range requirement.

Operational procedures are in effect at NLABS for assuring a bonafide need exists for a piece of equipment before acquisition is accomplished. These are summarized as follows; (1) a responsible investigator initiates a request for an item; (2) if over \$1000, the request is reviewed by the immediate supervisor and submitted to an appropriate Equipment Review Committee; (3) if the committee is satisfied with the justification and need the request is forwarded to the Laboratory Director for approval; (4) if approved the request goes to the Equipment Manager for determination of availability of the item within NLABS or as surplus from Defense Industrial Plant Equipment Center or Defense Logistics Service Office; (5) if unavailable the Equipment Manager so indicates on an inter-office memorandum and forwards the request for review by the Deputy Scientific Director for Research or Deputy Scientific Director for Engineering and final approval by the Scientific Director; (6) items under \$1000 are approved or disapproved by the Laboratory Director on the recommendation of the requestor's supervisor. Irrespective of the dollar amount all items are processed through the Equipment Manager for determination of availability within the total Laboratory complex. (7) Items available or requested from surplus are subjected to the same screening procedures as those which are to be purchased, except that the request is not submitted to the Scientific Director's Office for approval.

b. Utilization. Having established a bonafide need for an item, as part of a short and/or long range program, prior to equipment acquisition, utilization will follow as a natural consequence. However, turn-in or release of an item when no longer in use or obsolete does not always follow. Techniques which contribute to optimum utilization and turn-in are described below.

c. Turn-in of Unused, Excess or Obsolete Equipment. Turn-in is accomplished as a result of: (1) laboratory walk-throughs by supervisory and



management personnel; (2) disposal of old equipment to make room for new; (3) command inspections; (4) annual inventories required to update the Installation Property Book; and (5) housekeeping inspections. These techniques will be continued.

In addition the following procedure will be made a part of an NLABS regulation.

"The Laboratory Director shall through the Laboratory Property Officer obtain, upon request, from the Equipment Manager, a listing of all items of equipment for the organizational element appearing in his inventory. The listing shall designate the sub-hand receipt holder. Within one month following the annual physical inventory of equipment the Laboratory Director shall file a report with the Scientific Director indicating that all items on the equipment list are being utilized or shall indicate the disposition of such items as are found not utilized. Actual conduct of the utilization survey may be conducted in conjunction with the physical inventory survey or may be conducted at other appropriate times at the discretion of the Laboratory Director."

d. Equipment Pool. An Instrumentation and Equipment Pool was established and became operational in the 4th Quarter FY'68. It is currently stocked with 370 common mechanical, electrical, and electrical-mechanical items valued (new) at \$85,000. These items were turned-in voluntarily by the various laboratories. All items have been calibrated and are in operable condition. Currently 88 are out on loan with a total of 154 having been on loan during the 1st and 2nd Quarters, FY'69. This pool will continue to accumulate items as they are released by the researchers and investigators. No crash program will be initiated to effect a hasty and maximum turn-in of equipment. Rather, an orderly approach will be continued so as not to overtax limited storage, repair and calibration resources, but more particularly to develop confidence on the part of laboratory personnel that a properly run equipment pool can be a help and not a hindrance. Within the Department of the Army laboratories dedicated researchers have had compelling reasons to resist the turn-in of usable equipment. If a piece of equipment is not reclaimed within a year, Supply and Storage elements operating under Army Regulations normally dispose of such items within six months to a year. As a consequence the investigator then finds that when he needs the item it no longer is in storage. It may take him as much as a year to acquire it through procurement action with the expenditure of project funds.

The NLABS Equipment Pool is under the control of the Laboratory Support Office, a maintenance, repair and calibration element reporting directly to the Deputy Scientific Director for Engineering. All instruments or equipment turned-in by laboratory personnel are processed through the

Equipment Manager. Usable and repairable items are placed in the Equipment Pool. An accession list of items added to the pool is published periodically. Based on availability of like items and use experience, equipment in the pool may be declared excess. It will, however, not be disposed of through Supply and Storage channels until laboratory personnel have been queried of immediate or anticipated future need for the item(s).

An "Inventory Equipment Pool" which has been in effect for almost three years is continuing. This consists of a central listing and identification of the location of all equipment within the laboratory complex. The list is held by the Equipment Manager. A required item can be quickly located if there is one in-house, and a determination is made on its availability for transfer, loan or joint use. This Inventory Pool has proven to be very useful. Three hundred and thirty-four items valued (new) at \$128,000 were transferred between laboratories during FY'68. An added advantage of an "inventory" or "in-place" pool is a saving in manpower and elimination of the need for central storage or holding space. Two thousand, little used but needed, instruments can be held throughout a laboratory complex, whereas centralized holding of 2000 would require 19,200 cubic feet or a single room 20' x 80' x 12' high. (This is calculated on the basis of 400 items stocked on shelves in a room 20' x 16' x 12'.)

e. Maintenance, Repair, and Calibration of Equipment. Maintenance, repair and calibration is a responsibility of the Laboratory Support Office. Currently maintenance and especially repair of laboratory instruments is accomplished at the request of responsible users or custodians of equipment. Calibration is covered by D/A and AMC regulations and implemented at NLABS in consonance with these regulations. During FY'68 a calibration facility was established and became operational in the first quarter FY'69. This is in addition to calibration services furnished through the Army Meteorology and Calibration Center, and services procured from commercial sources. NLABS calibration program will eventually be based on an automatic recall system, as backlogs are eliminated and calibration resources become available. As each item requiring calibration is checked in and out by the Laboratory Support Office appropriate ones will be equipped with elapsed-time meters to provide quantitative information for calibration and maintenance. Current calibration guidelines call for the automatic recall of items at either 6, 9, or 12 month intervals irrespective of total hours of usage. Definitive information is not available as to whether reliability of a given item is time dependent, use dependent or time and use dependent. When this information is available calibration periods can be scheduled on a realistic rather than a arbitrary basis. This will be a continuing program extending over a period of years.

Laboratory equipment and instrumentation at NLABS numbers approximately 15,000 pieces. An estimated 2,000 - 2,500 pieces of equipment will lend themselves to installation of elapsed-time meters for calibration purposes. As an additional spin-off from this program for those items

showing little actual elapsed-time usage, the custodian (researcher) will be queried as to whether or not the frequency of use requires the retention of the item in his possession or whether he can release it to the Equipment Pool.

f. Annual Inventory. This is accomplished in accordance with Department of the Army and Army Materiel Command regulations.

## U.S. Army Laboratories Equipment Management and Utilization Study

The US Army Natick Laboratories (NIABS) in June 1965 formalized its Equipment Management Program. The basic objective was improved management and utilization of non-expendable equipment or instrumentation on hand, and assurance that there was a bonafide requirement for new acquisitions.

On 1 September 1967 the Scientific Director appointed an Advisory Committee on Equipment Utilization to study the matter and to develop a policy document on methods of efficient equipment utilization. A specific phase of the study was an investigation of the use of elapsed-time meters.

The Committee was composed of representatives of the Scientific Director's staff, laboratory directors and bench scientists/engineers, and the Equipment Manager. (See Appendix)

In their studies the Committee considered four major factors which have an influence on equipment management and utilization. These were: (1) acquisition; (2) utilization; (3) turn-in of unused, excess or obsolete equipment; and (4) an equipment pool. Accordingly, four subcommittees of three members each from the main committee were established to cover the four areas. The findings and recommendations of each subcommittee are summarized in the following pages.

a. Subcommittee on Acquisition of Equipment. Equipment management at the U.S. Army Natick Laboratories begins with the intent on the part of a researcher, engineer, or technologist to acquire non-expendable items as working tools for his laboratory unit. Need and potential utilization is determined at this point. A procedure in effect since 2 December 1966 requires that each of NLABS' six principal laboratories appoint appropriate and qualified review panels to examine each request for the acquisition of new equipment costing \$5,000 or over. This is done to assure that a need exists, the correct type of equipment is being procured, and that it will be used in an on-going or planned program. Several of the Laboratories extended this to cover acquisitions costing \$1,000 or more.

The subcommittee recommended that all laboratories have an internal review board for all instrumentation or equipment costing \$1,000 or over. Furthermore, the review procedure should apply to the acquisition of excess equipment (external to NLABS).

b. Subcommittee on Equipment Utilization (Elapsed-Time Meters). This subcommittee was assigned responsibility for having 100 elapsed-time meters attached to items of equipment throughout the laboratories, and for recording and analyzing the results with respect to the value of the meter for determining optimum utilization.

Within the past two years two studies were conducted at NLABS involving the use of elapsed-time meters. The first study initiated in 1966 was conducted by the Equipment Manager. Installation of elapsed-time meters on laboratory equipment was presented to the laboratory directors and personnel on the basis that the primary function was to identify the need for instrument calibration, with any "spin-off" on hours of utilization to be used by the laboratory director (manager) for adjusting the availability of instruments to his personnel.

Data from this first test was presented at an Army Materiel Command Equipment Management Workshop, 31 January - 3 February 1967. Unfortunately in the interpretation and reporting of the data following the presentation the emphasis appeared to be on equipment utilization and not on calibration. From this point on "utilization" became a focal point of discussion and controversy.

In the fall of 1967 a second test of elapsed-time meters was scheduled at NLABS with emphasis on "utilization". The study was by direction of the Scientific Director and was supervised by a subcommittee of three. One-hundred and fifty-five electrical or electrical-mechanical items were selected. Of the 155 units, it was found impractical to install elapsed-time meters on 66 units, leaving 89 suitable for the test. Sixty-two pieces remained at the end of the test (9 months) with 27 being removed from the test for a variety of reasons, such as repair, transfer (when certain laboratory activities were moved to another AMC laboratory), turn-in and replacement.

The results of the experiment showed:

- 42% of the items were used 25% of the time or more
- 9% of the items were used between 10.1% and 25% of the time
- 23% of the items were used between 5.1% and 10% of the time
- 15% of the items were used between 0.1% and 5% of the time
- 11% of the items showed no reading on the time elapse meters

These results follow the same general pattern as that reported by the Equipment Manager in his study which showed:

- 26% of the items checked were used 25% of the time or more
- 19% of the items checked were used 10.1% to 25% of the time
- 8% of the items checked were used 5.1% to 10% of the time
- 31% of the items checked were used 0.1% to 5% of the time
- 16% showed no reading on the time elapse meters

Based on information obtained from the manufacturer of time elapse meters, nine organizations using their produce were contacted. The results of this inquiry are summarized in Table I.

Table I. Survey of Use of Elapsed-Time Meters

Org.	Activity	Elapsed-Time Meters Used for		Remarks
		Calib.	Util.	
A	Eng. Development	Yes	Yes	Installation of meters was met with deep resentment. Meters were removed, mutilated, disconnected, etc. The practice was stopped by expropriating the instrument.
B	Research	Yes	No	Not enough data to determine possible effectiveness for equipment utilization.
C	Development and manufacture of gyroscope systems	Yes	No	Head of instrument maintenance and calibration believes meters will be useful for equipment utilization determination.
D	Research and development of aircraft systems	Yes	No	Plans to use meters to establish an equipment utilization program.
E	Manufactures scientific instruments and electronic tubes; some research	Yes	No	This organization does not think highly of the instruments and is not using them to any large extent now.
F	Research, development and some production work on computer systems	Yes	Yes	Most useful on instruments used in production testing.
G	Electronic instruments	Yes	No	Primary purpose, instrument calibration.

Table I. (Cont'd)

Org.	Activity	Elapsed-Time Meters Used for		Remarks
		Calib.	Util.	
H	Research	Yes	No	Used for calibration and servicing purposes only. Considering possible use for determining utilization.
I	Production of electronic instruments and research	Yes	No	Elapsed-time meters used in quality control, testing and research.

In every instance, irrespective of the type of work being conducted, the primary purpose is for calibration (which may also include service and maintenance). This is in agreement with the manufacturer's advertised use of elapsed-time meters. The individual supplying the information on each company's use of elapsed-time meters was in all cases the head or chief of the (instrument) calibration, maintenance, and repair facility.

The equipment utilization subcommittee felt that the difficulties encountered in obtaining meaningful measurements result from the fact that effective utilization of scientific equipment in an R&D establishment is not solely or primarily a function of time. Elapsed-time meters which measure only total time but not frequency of use cannot therefore be used as a measure of effective equipment utilization. For example, a pH or voltmeter might be used every day, over a period of six months, but show little or nothing on an elapsed-time meter.

The subcommittee was of the opinion that elapsed-time meters could be used effectively in calibration of equipment which in turn may have a "spin-off" with respect to utilization. In the case of those items which show little elapsed-time readings the custodian (researcher) should be contacted relative to release of the item to the equipment pool.



c. Subcommittee on Disposal of Unused Equipment. This committee's assignment was to study ways and means of getting the separate laboratories to take positive action in disposal of unused, excess, or obsolete equipment. The consensus of the committee was that expediting the turn-in of equipment should be accomplished within the framework of existing procedures, i.e., by walk-throughs, disposal of old equipment to make room for new, command inspections, annual inventories and housekeeping inspections. Furthermore, the Laboratory Director shall through the Laboratory Property Officer obtain, upon request, from the Equipment Manager, a listing of all items of equipment for the organizational element appearing in his inventory. The listing shall designate the sub-hand receipt holder. Within one month following the annual physical inventory of equipment, the Laboratory Director shall file a report with the Scientific Director indicating that all items on the equipment listing are being utilized or shall indicate the disposition of such items as are found not utilized. Actual conduct of the utilization survey may be conducted in conjunction with the physical inventory or may be conducted at other appropriate times at the discretion of the Laboratory Director.

d. Subcommittee on Equipment Pool. This group was to participate in the establishment of an Equipment Pool, to develop a tentative policy on the method of operation of an equipment pool, and consider the justification for a pool in terms of advantages and disadvantages to the laboratories. (Prior to the appointment of the Advisory Committee on Equipment Utilization and this subcommittee, a decision had been made at Command level to establish an Equipment Pool).

It was the majority but not unanimous opinion of the Subcommittee that an equipment pool at NLABS would not increase the effectiveness of the R&D dollar. Nevertheless an equipment pool has been established and is stocked with 370 mechanical, electrical and electrical-mechanical instruments valued (new) at \$85,000. All of these items were turned-in by the various laboratories. All are in operable condition. Currently 88 are out on loan with a total of 154 having been on loan during the first six months since the pool was activated. In addition an "Inventory Equipment Pool" has been in operation through the Equipment Manager's Office for almost three years. This consists of a listing with location of all equipment in the laboratories. As required transfer, loan or joint use of instruments between laboratories can be effected. The subcommittee agreed unanimously on the continuation of the inventory pool. (During FY'68 approximately 334 items of equipment valued (new) at \$128,000 were transferred between laboratories).

With respect to the equipment pool the subcommittee further agreed that an accession list should be published periodically and that no items in the pool should be declared excess to NLABS needs until laboratory personnel had been queried relative to immediate or anticipated future need for the item(s).

## APPENDIX

NLABS Equipment Utilization Advisory Committee. (Appointed by the Scientific Director, 23 August 1967).

Dr. J. Fred Oesterling, Deputy Scientific Director for Research - CHAIRMAN

Dr. Gabriel R. Mandels, Pioneering Research Lab  
Dr. Malcolm C. Henry, Clothing & Personal Life Support Equipment Lab  
Dr. Julius Weinstein, Pioneering Research Lab  
Dr. Edward M. Healy, Clothing & Personal Life Support Equipment Lab  
Dr. J. Walter Giffey, Food Lab  
Dr. Rauno A. Lampi, General Equipment & Packaging Lab  
Mr. Arthur Levine, Equipment Manager  
Dr. Raymond D. Cooper, Food Lab  
Dr. Herbert A. Hollender, Food Lab  
Mr. Gerald Schulz, General Equipment and Packaging Lab  
Dr. Charles Merritt, Jr., Pioneering Research Lab  
Mr. Angelo P. Maschi, Airdrop Engineering Lab  
Mr. Arthur Addelson, Management Division

Subcommittees (Appointed by Chairmen of the Main Committee, 7 September 1967)

### Subcommittee on Acquisition of Equipment

Dr. Herbert A. Hollender, Chairman  
Dr. Rauno A. Lampi  
Dr. Edward M. Healy

### Subcommittee on Equipment Utilization (Elapsed-Time Meters)

Dr. Malcolm C. Henry, Chairman  
Dr. Julius Weinstein  
Dr. Raymond D. Cooper

### Subcommittee on Disposal of Unused Equipment

Dr. Charles Merritt, Jr., Chairman  
Dr. J. Walter Giffey  
Mr. Angelo P. Maschi

### Subcommittee on Equipment Pool

Dr. Gabriel R. Mandels, Chairman  
Mr. Arthur Levine  
Mr. Gerald Schulz

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Equipment	9,4		9,4			
Army Natick Laboratories	0		0			
Measuring			8			
Calibrating			4			